FIG. 1
(PRIOR ART)

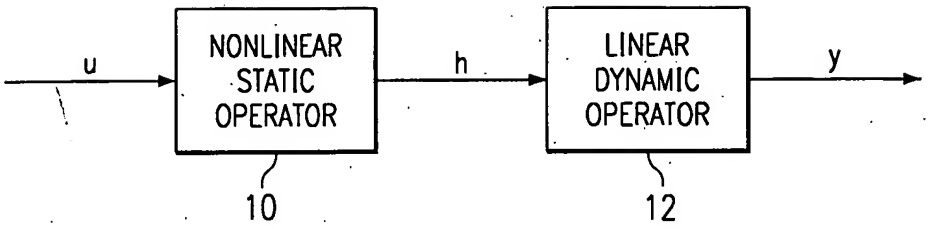
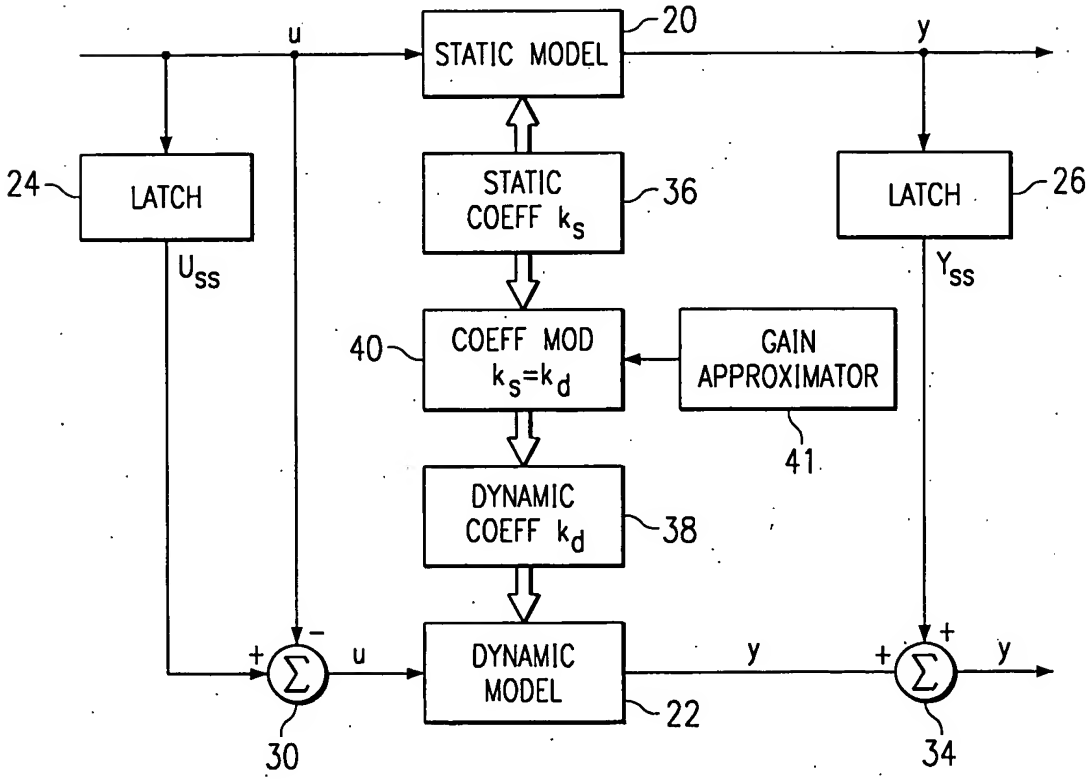


FIG. 2



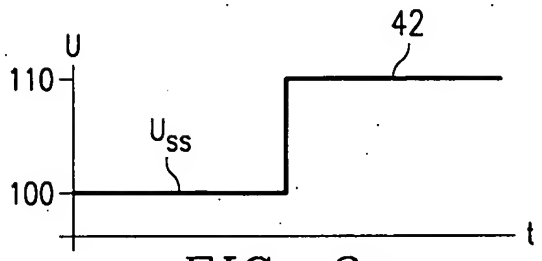


FIG. 3a

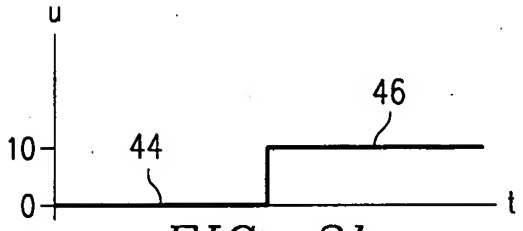


FIG. 3b

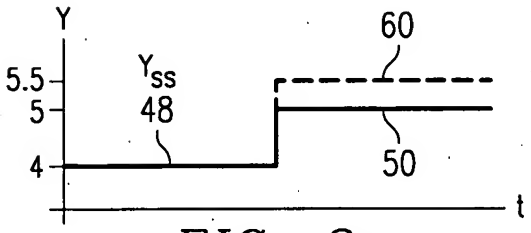


FIG. 3c

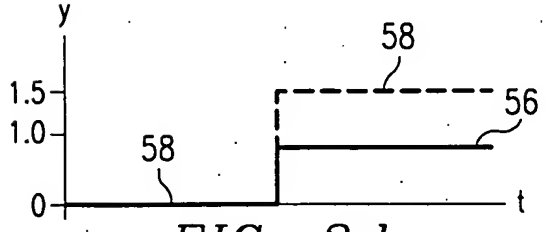


FIG. 3d

20040705.0160-5647400

FIG. 4

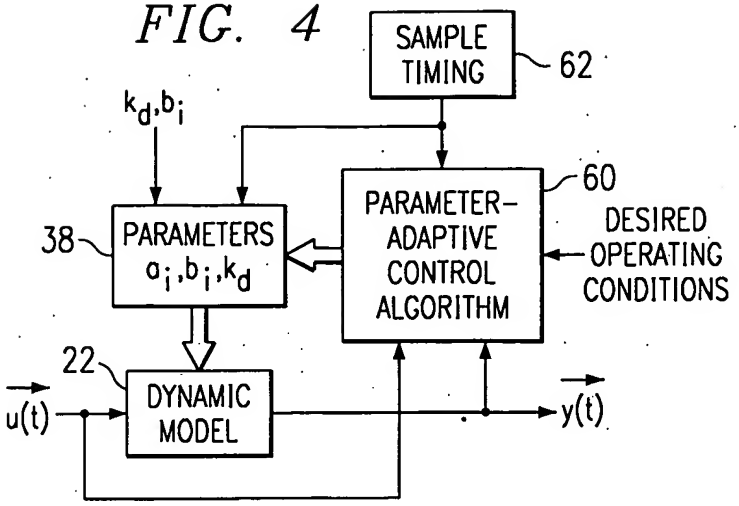


FIG. 5

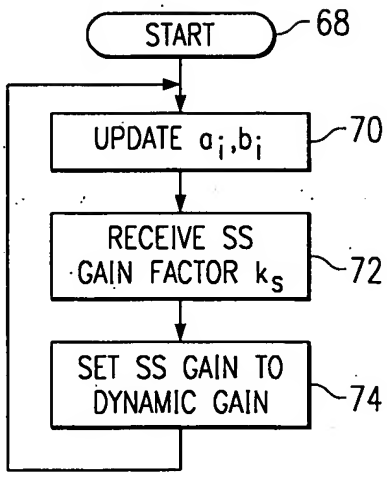
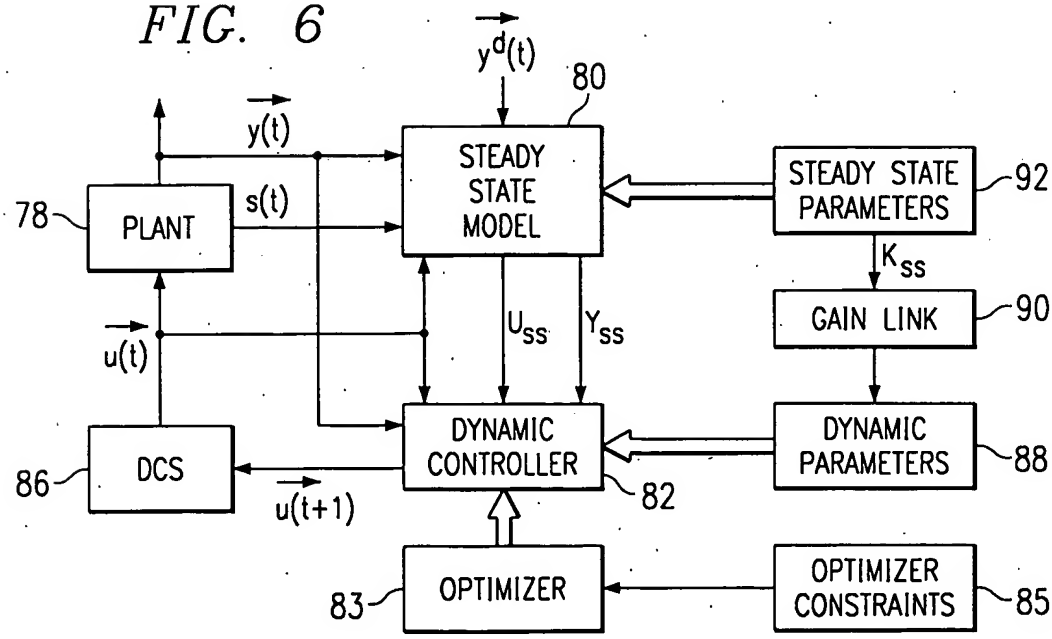


FIG. 6



EP0474595A2

FIG. 7

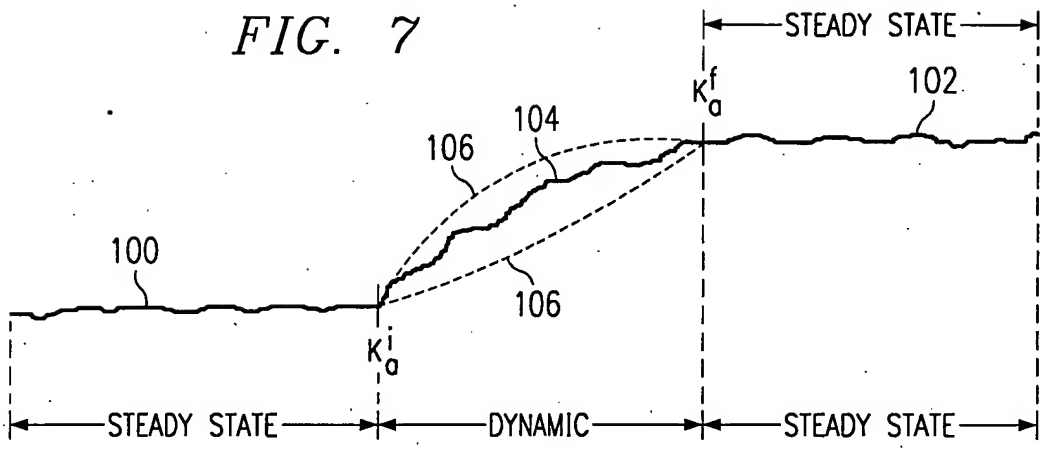

STEADY STATE
K_a^f
102
104
106
106
100
K_a^i
STEADY STATE
DYNAMIC
STEADY STATE

FIG. 8

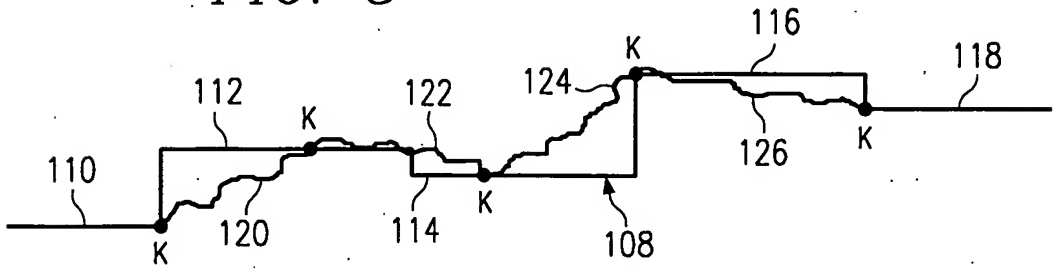

116
K
118
112
K
122
124
110
K
120
114
K
108
126
K

FIG. 9

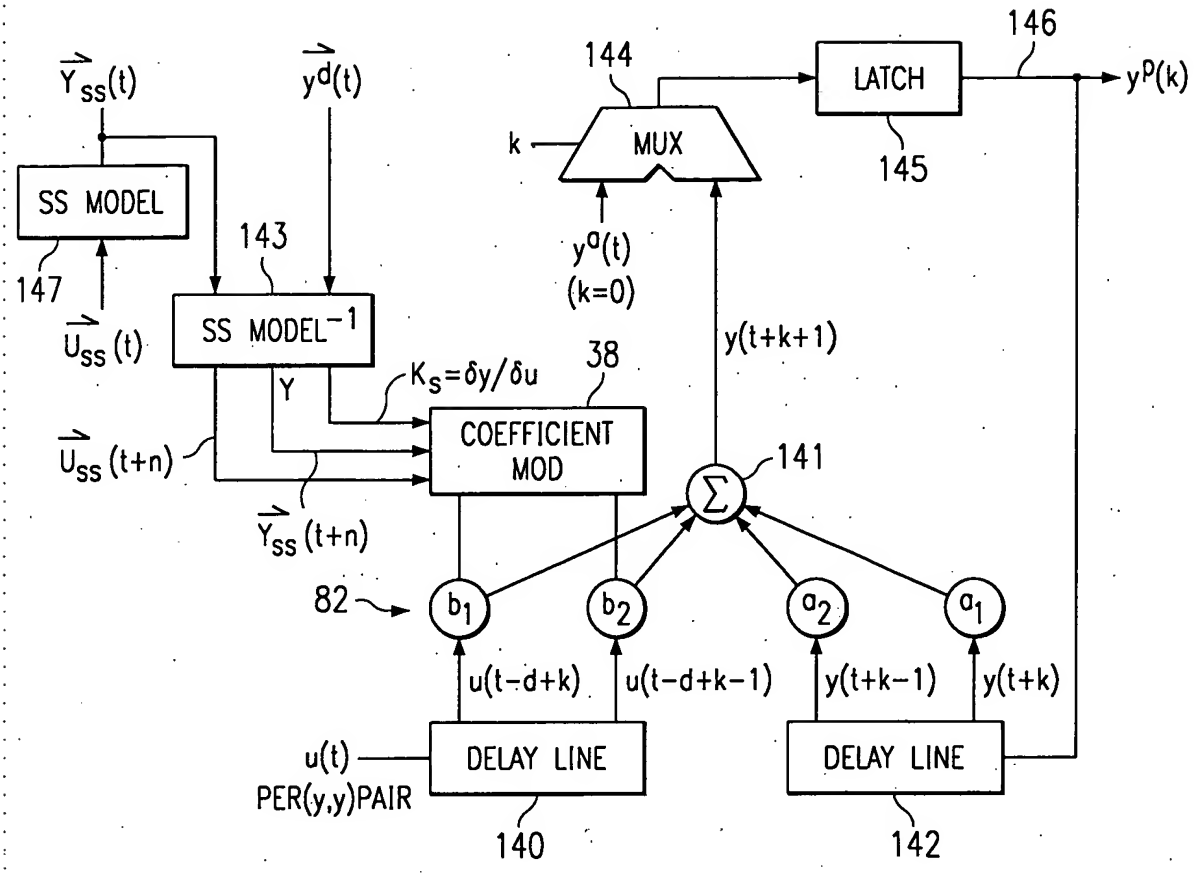
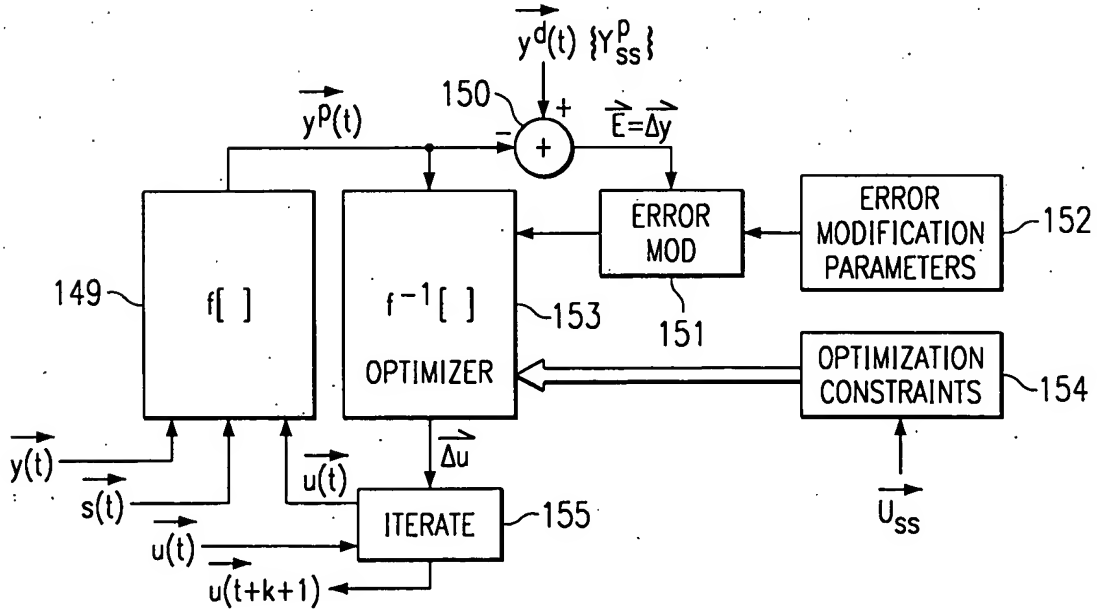

$\vec{Y}_{ss}(t)$
$\vec{y}^d(t)$
144
LATCH
146
$y^p(k)$
k
MUX
145
SS MODEL
143
147
$\vec{U}_{ss}(t)$
SS MODEL^{-1}
$y^a(t)$
(k=0)
y(t+k+1)
38
$K_s=\delta y/\delta u$
Y
$\vec{U}_{ss}(t+n)$
COEFFICIENT MOD
141
$\vec{Y}_{ss}(t+n)$
82
b_1
b_2
a_2
a_1
u(t-d+k)
u(t-d+k-1)
y(t+k-1)
y(t+k)
u(t)
PER(y,y)PAIR
DELAY LINE
DELAY LINE
140
142

FIG. 10


$\vec{y}^d(t)$ $\{Y^p_{ss}\}$
150
$\vec{y}^p(t)$
+
−
+
$\vec{E}=\vec{\Delta y}$
ERROR MOD
ERROR MODIFICATION PARAMETERS
152
149
f[ ]
$f^{-1}[\ ]$
OPTIMIZER
153
151
OPTIMIZATION CONSTRAINTS
154
$\vec{y}(t)$
$\vec{s}(t)$
$\vec{u}(t)$
$\vec{\Delta u}$
ITERATE
155
$\vec{U}_{ss}$
$\vec{u}(t)$
$\vec{u}(t+k+1)$

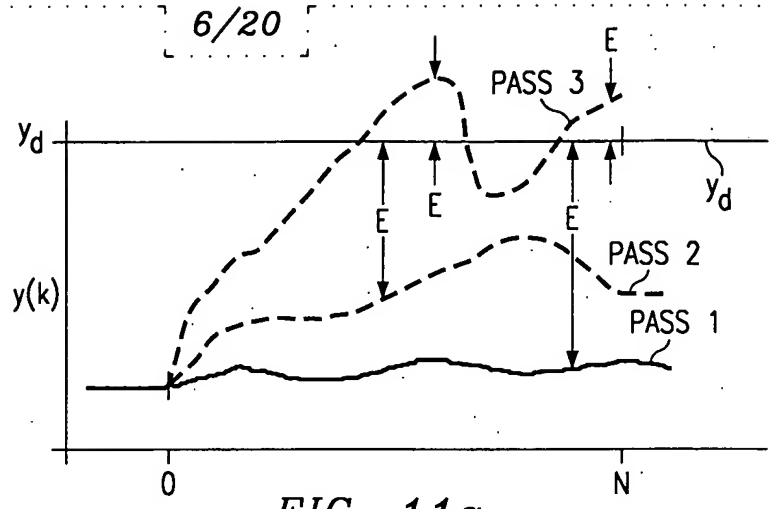


FIG. 11a

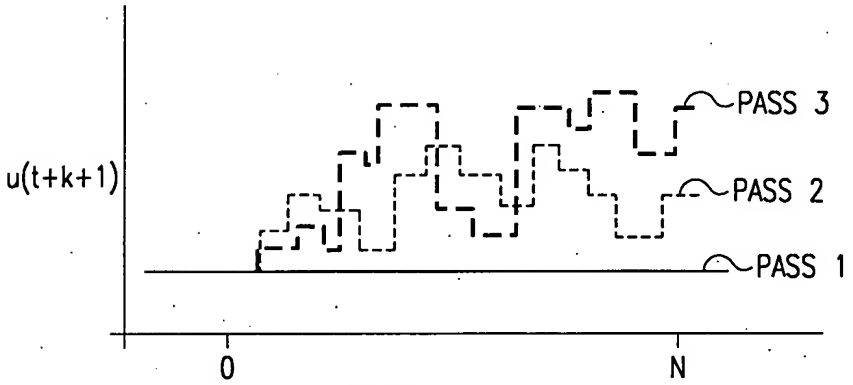


FIG. 11b

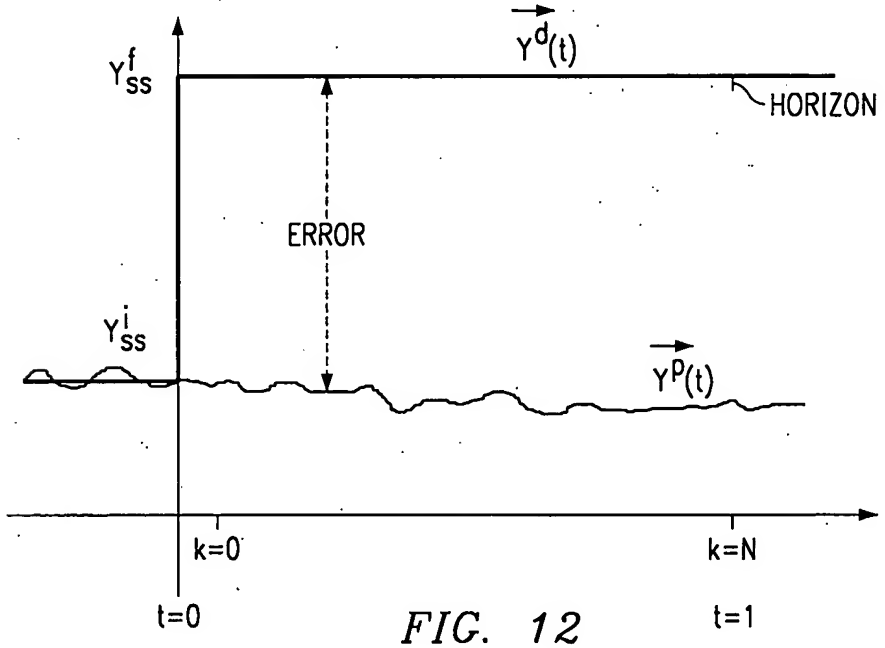


FIG. 12

20060510 - 95274004

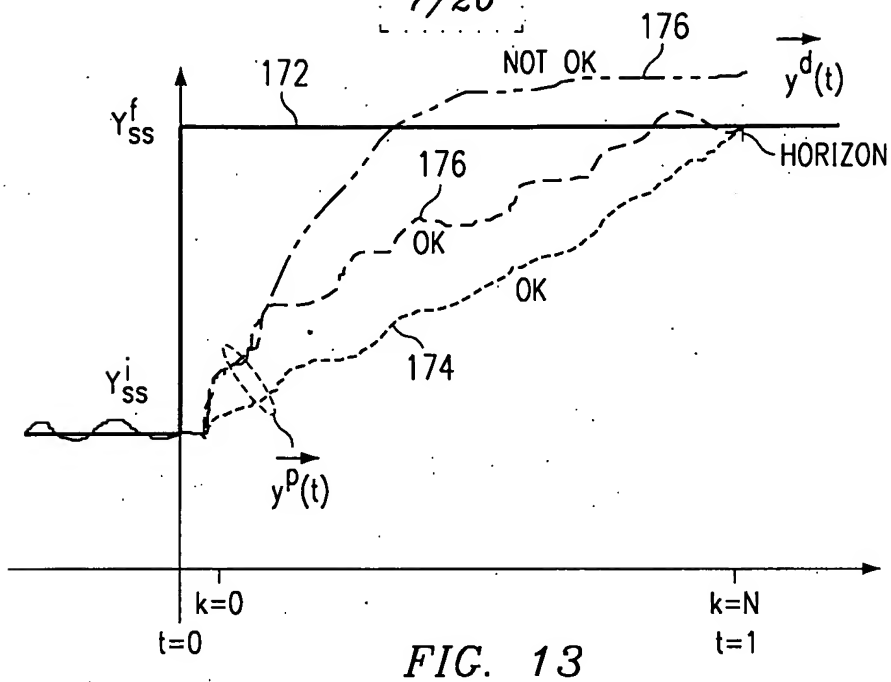


FIG. 13

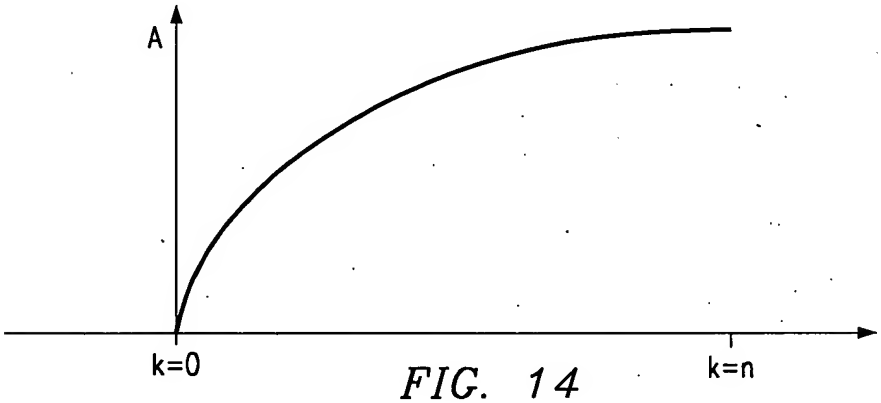


FIG. 14

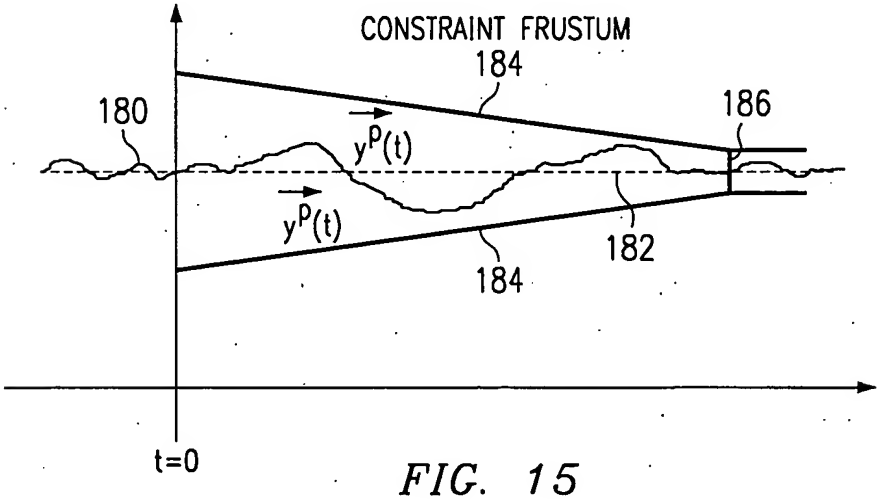


FIG. 15

20080249474A1

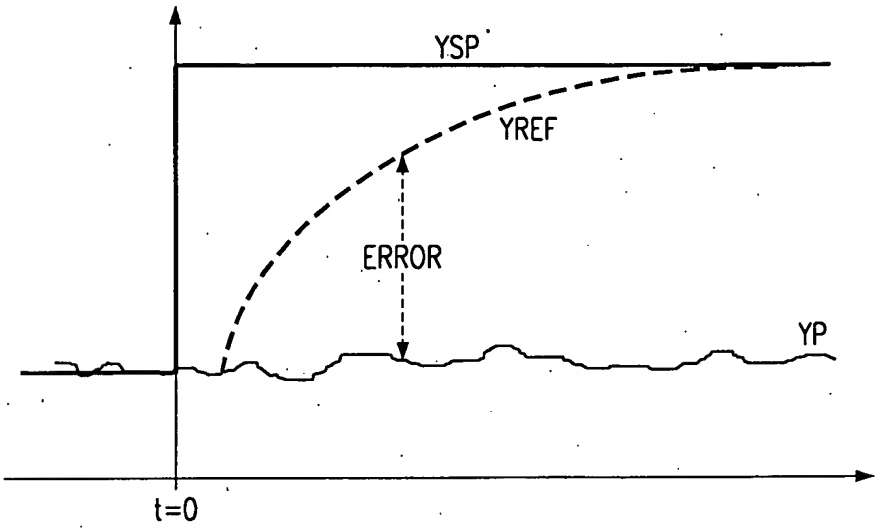


FIG. 16

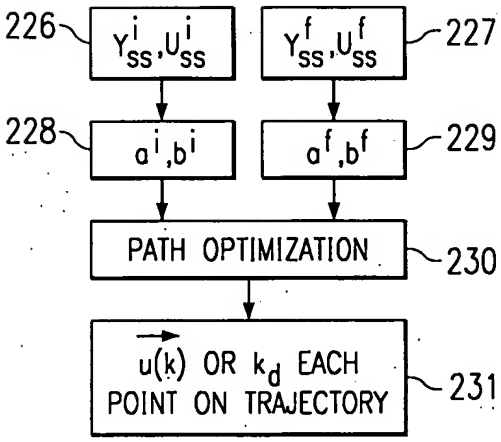


FIG. 18

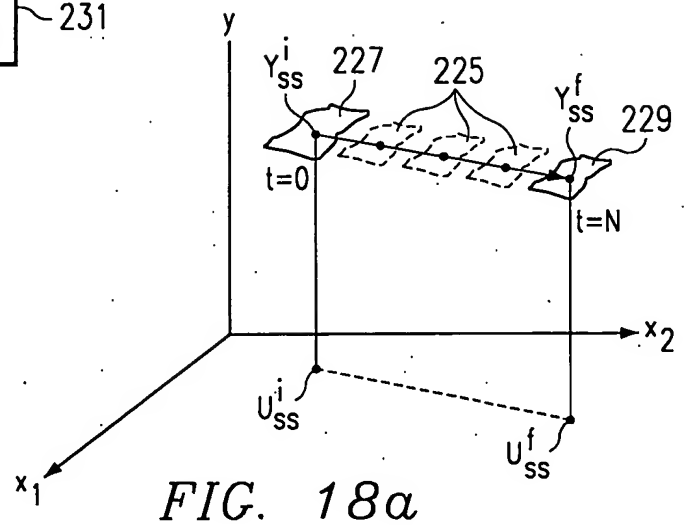


FIG. 18a

20040769.000400

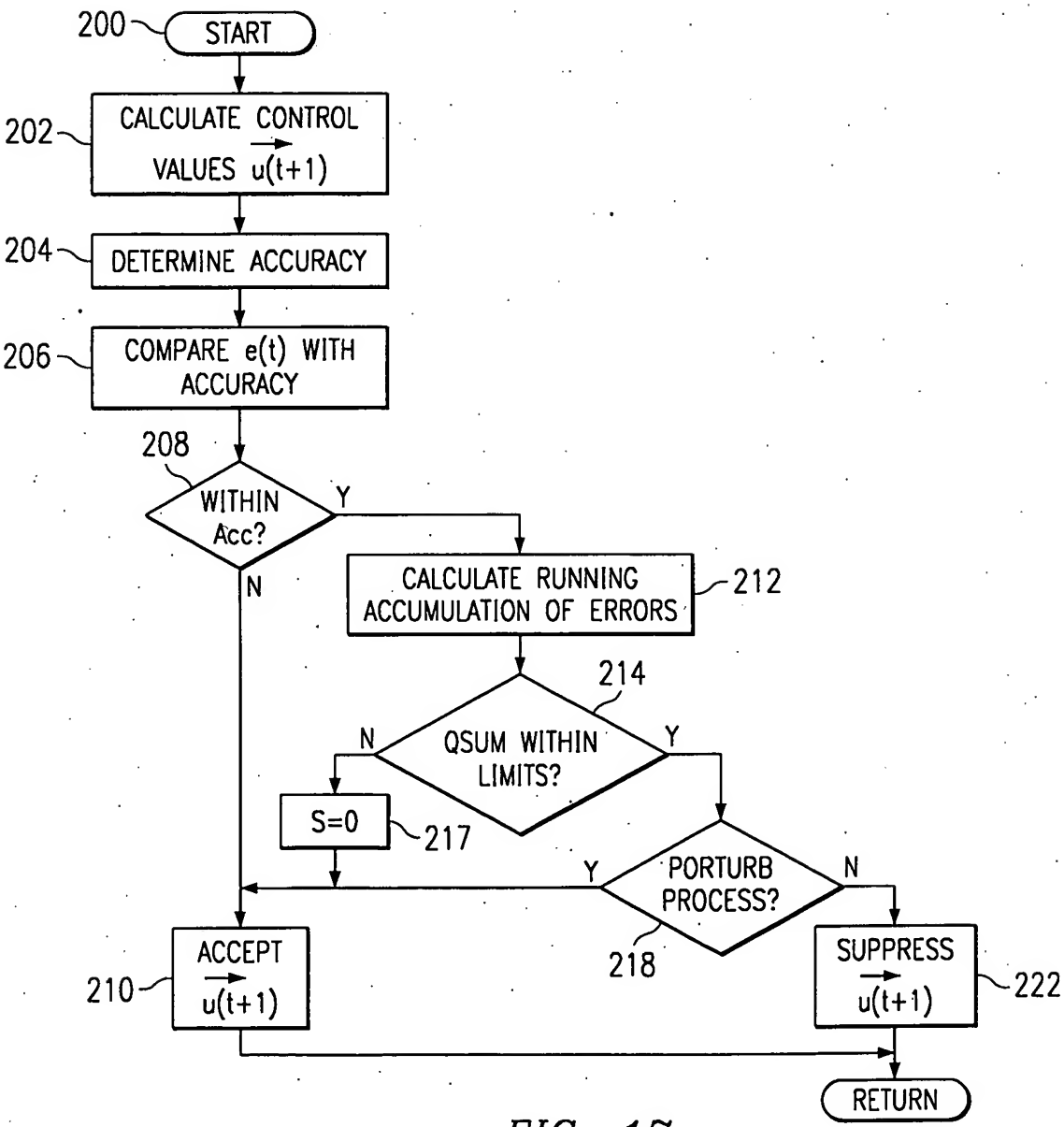

200
START
202
CALCULATE CONTROL VALUES u(t+1)
204
DETERMINE ACCURACY
206
COMPARE e(t) WITH ACCURACY
208
WITHIN Acc?
Y
N
CALCULATE RUNNING ACCUMULATION OF ERRORS
212
214
QSUM WITHIN LIMITS?
N
Y
S=0
217
PORTURB PROCESS?
Y
N
218
ACCEPT u(t+1)
210
SUPPRESS u(t+1)
222
RETURN

FIG. 17

FIG. 19

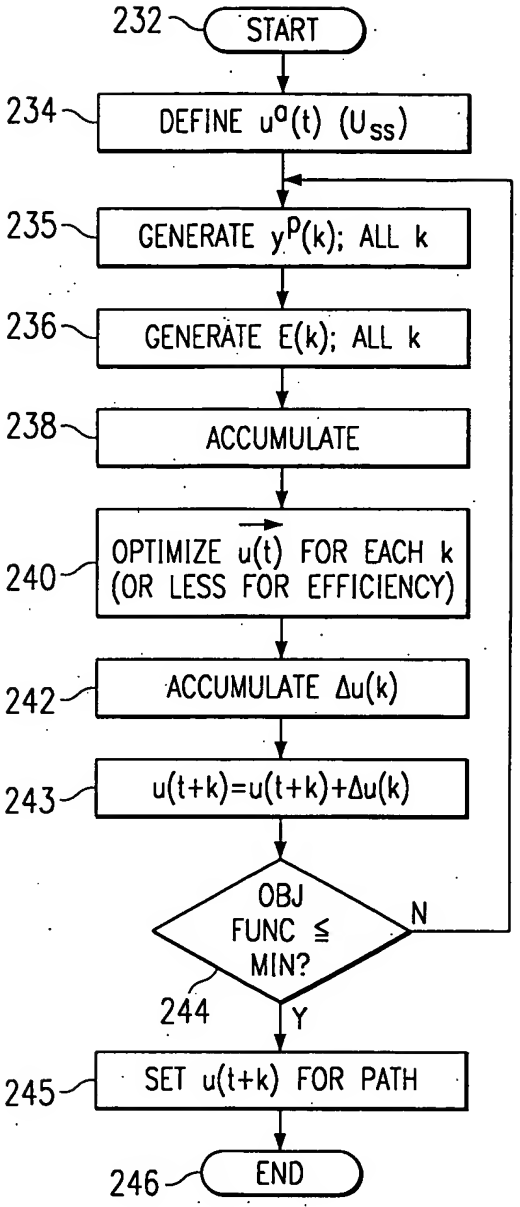


FIG. 20

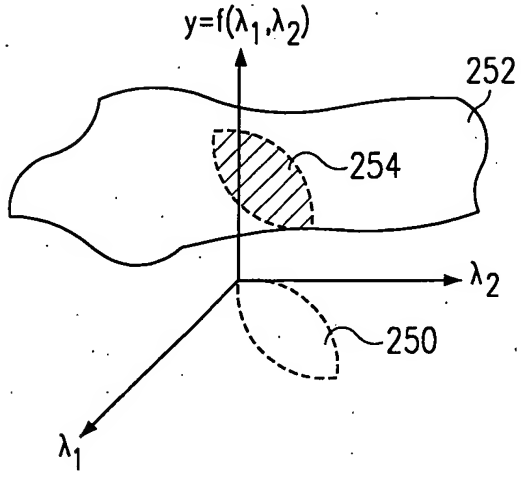
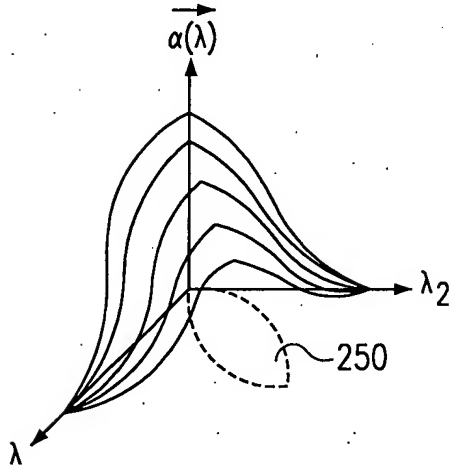
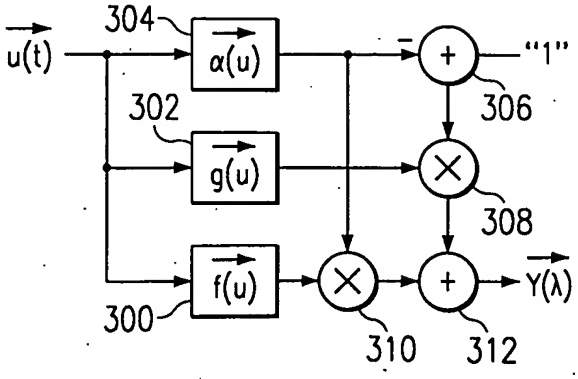


FIG. 21



1

FIG. 22



EXPRESS MAIL NO. EV 044795 695 US

FIG. 23

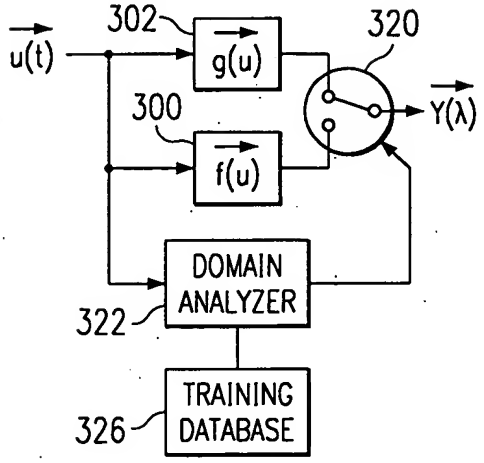


FIG. 24

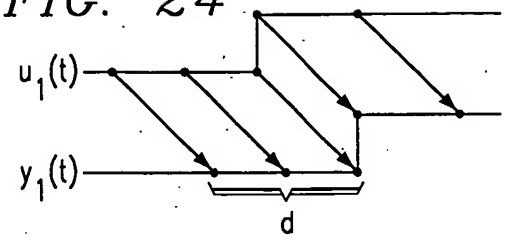


FIG. 25

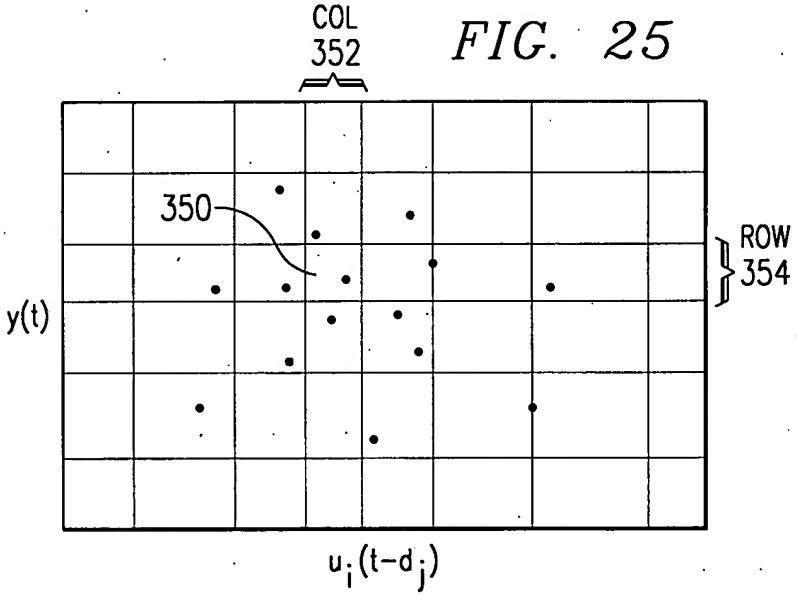
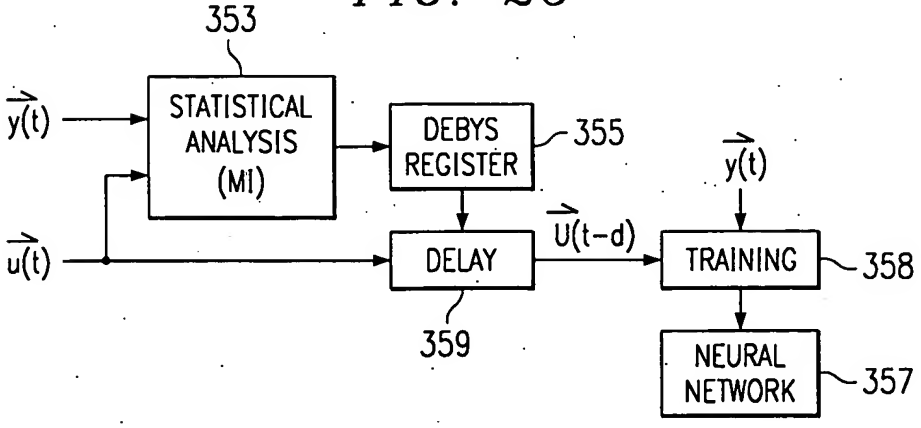


FIG. 26



ED_004376_00000048

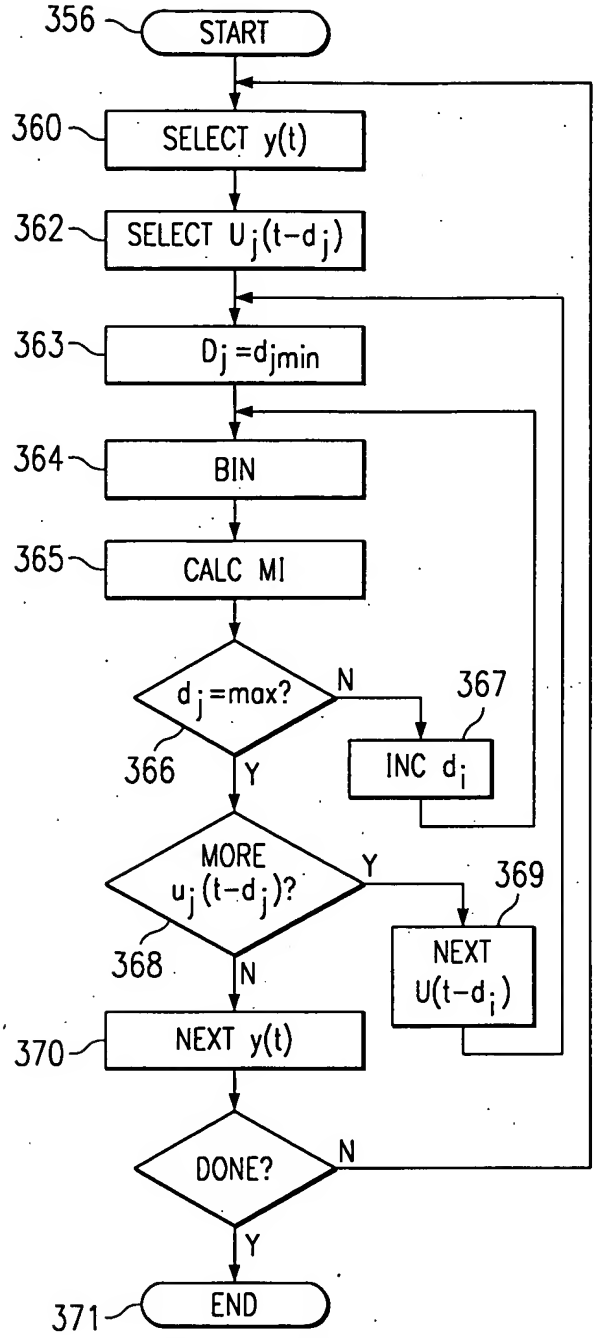


FIG. 27

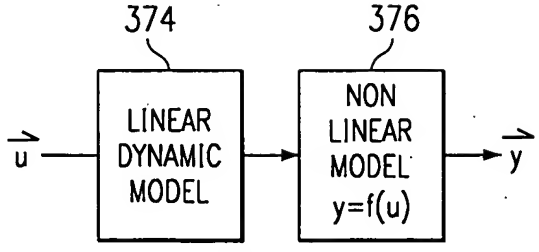


FIG. 28
(PRIOR ART)

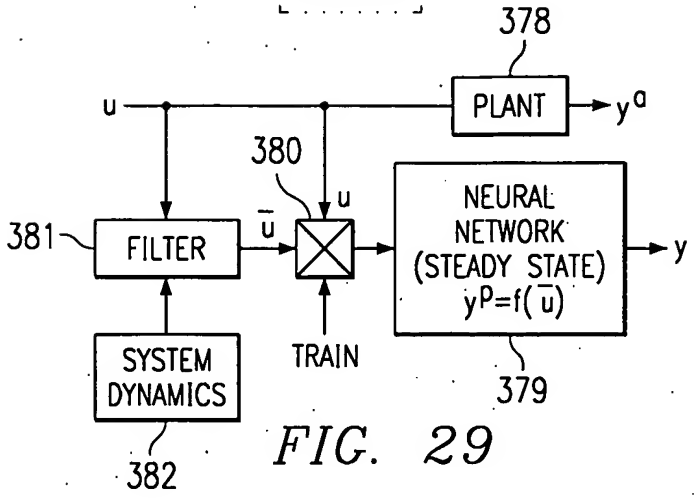


FIG. 29

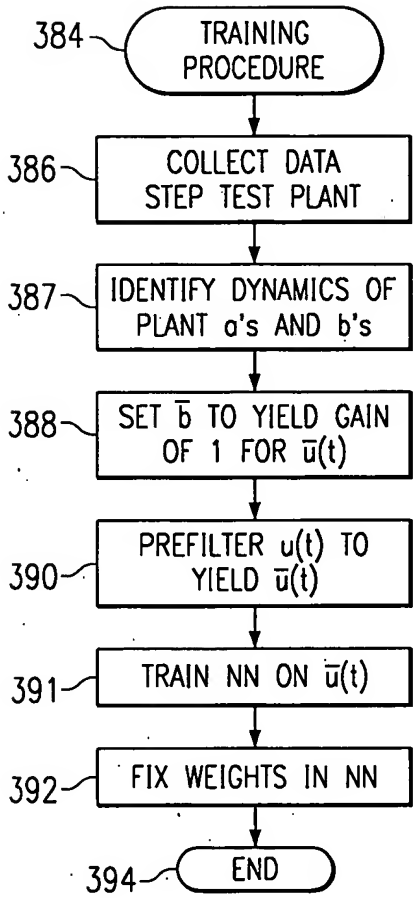


FIG. 31

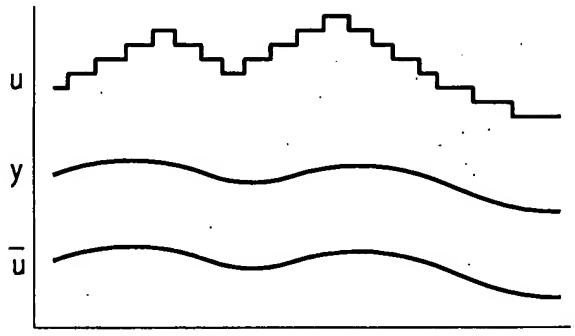


FIG. 30

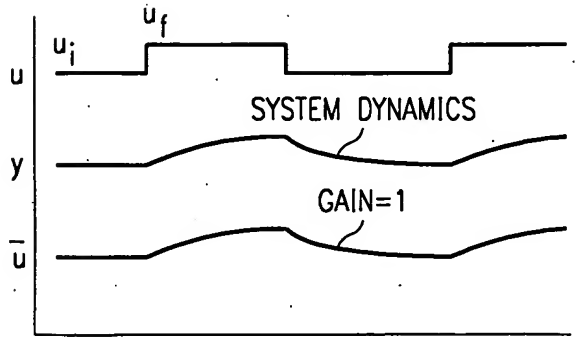


FIG. 32

4004760 05/08/03

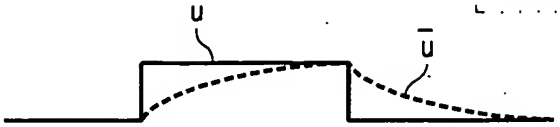


FIG. 33

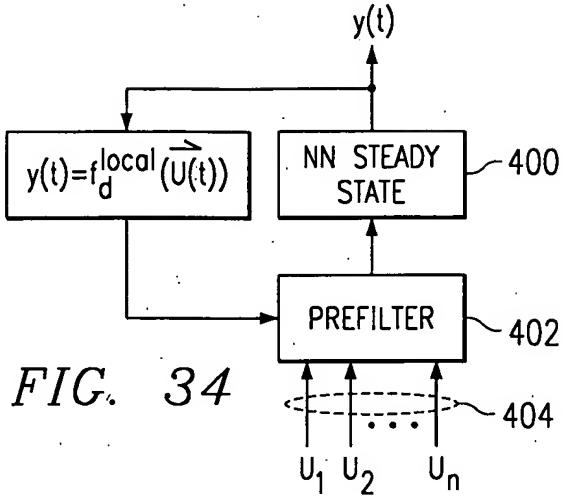


FIG. 34

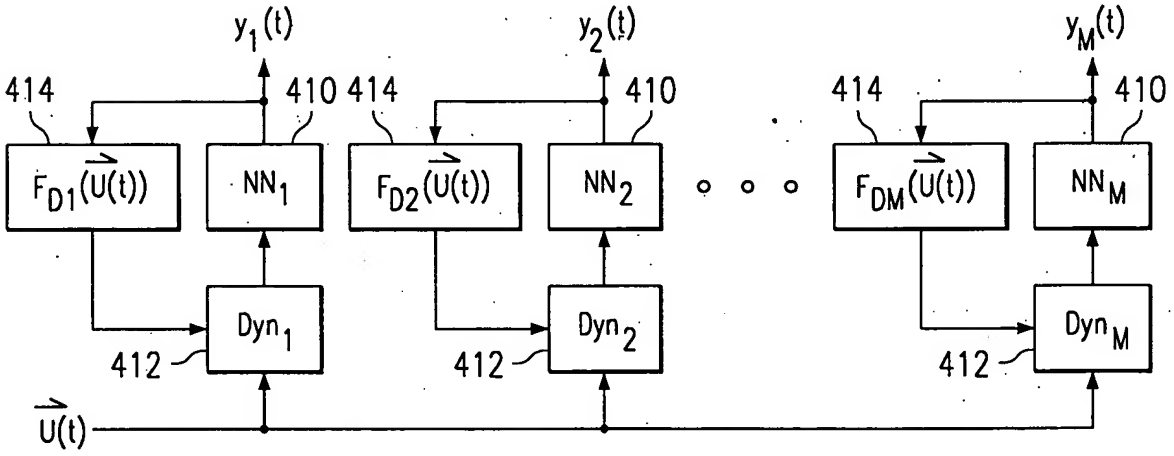


FIG. 35

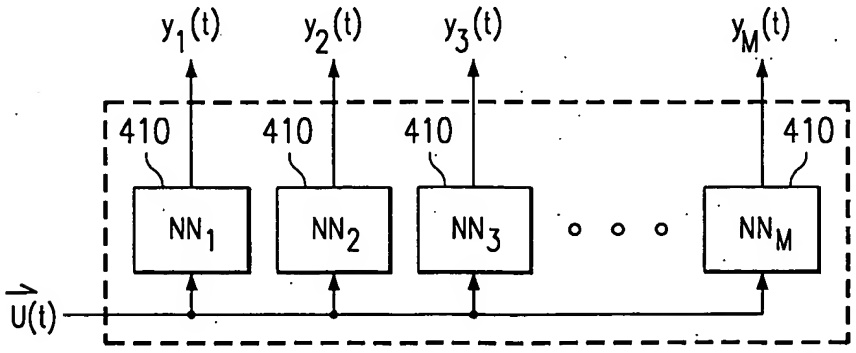
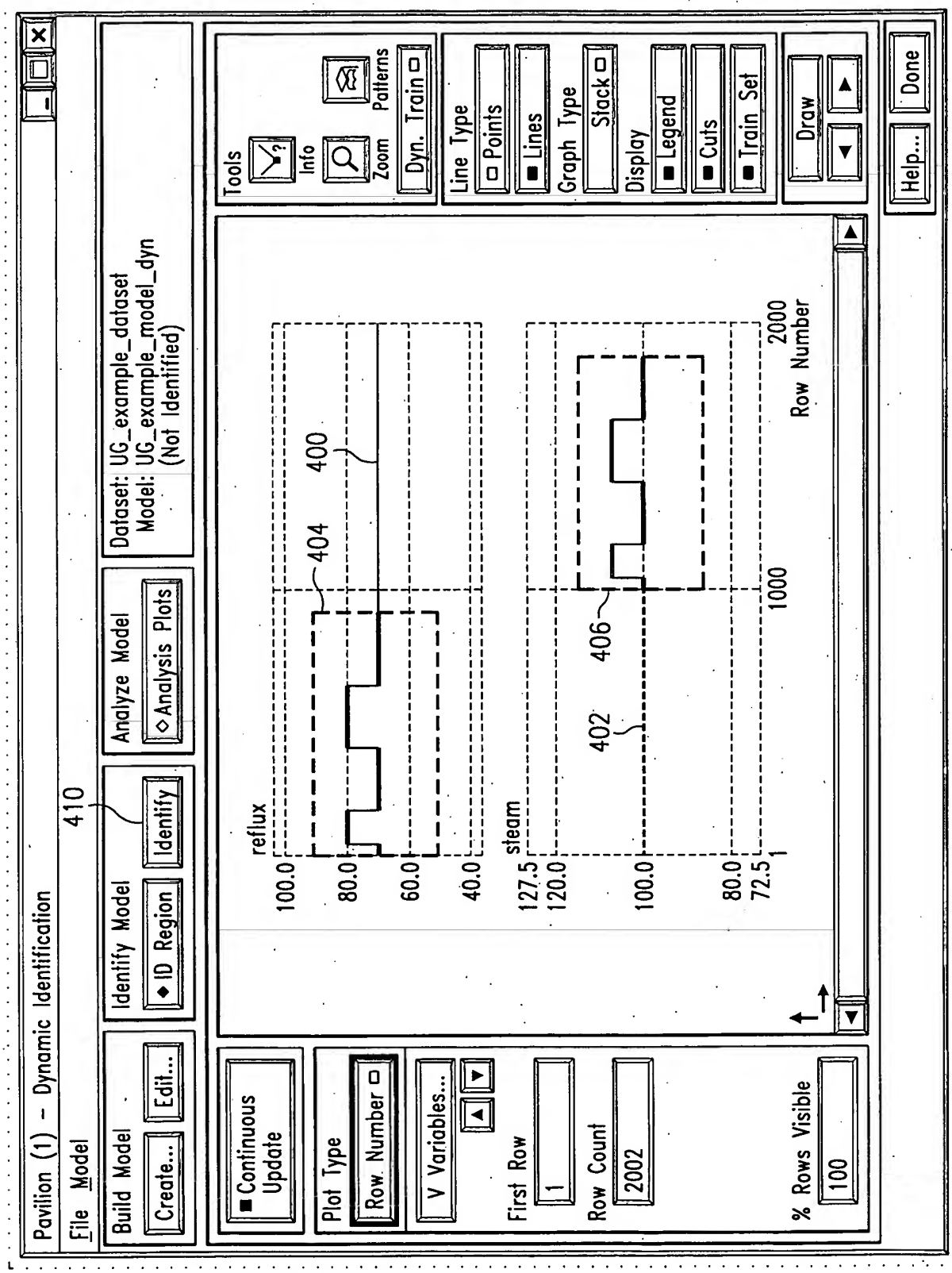


FIG. 36

FIG. 37


Pavilion (1) - Dynamic Identification
File Model
410
Build Model
Create...
Edit...
Identify Model
◆ ID Region
Identify
Analyze Model
◇ Analysis Plots
Dataset: UG_example_dataset
Model: UG_example_model_dyn
(Not Identified)
Tools
Info
Zoom
Patterns
Dyn. Train
Line Type
Points
Lines
Graph Type
Stack
Display
Legend
Cuts
Train Set
Draw
Help...
Done
■ Continuous Update
Plot Type
Row Number
V Variables...
First Row
1
Row Count
2002
% Rows Visible
100
reflux
100.0
80.0
60.0
40.0
404
400
steam
127.5
120.0
100.0
80.0
72.5
402
406
1
1000
2000
Row Number

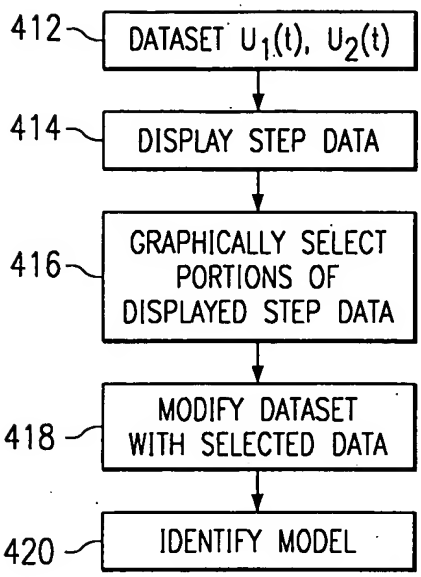

412
DATASET $U_1(t)$, $U_2(t)$
414
DISPLAY STEP DATA
416
GRAPHICALLY SELECT PORTIONS OF DISPLAYED STEP DATA
418
MODIFY DATASET WITH SELECTED DATA
420
IDENTIFY MODEL

FIG. 38

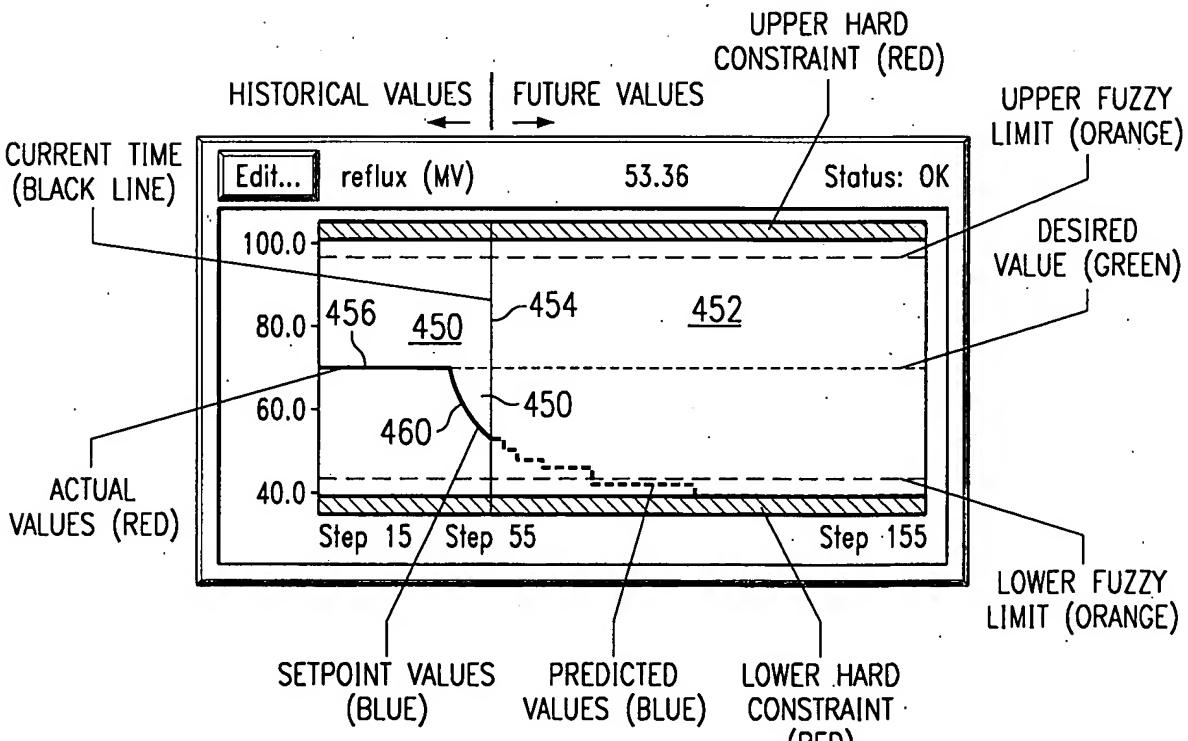

UPPER HARD CONSTRAINT (RED)
HISTORICAL VALUES
FUTURE VALUES
UPPER FUZZY LIMIT (ORANGE)
CURRENT TIME (BLACK LINE)
Edit...
reflux (MV)
53.36
Status: OK
DESIRED VALUE (GREEN)
100.0
80.0
60.0
40.0
456
450
454
452
460
450
ACTUAL VALUES (RED)
Step 15
Step 55
Step 155
LOWER FUZZY LIMIT (ORANGE)
SETPOINT VALUES (BLUE)
PREDICTED VALUES (BLUE)
LOWER HARD CONSTRAINT (RED)

FIG. 39

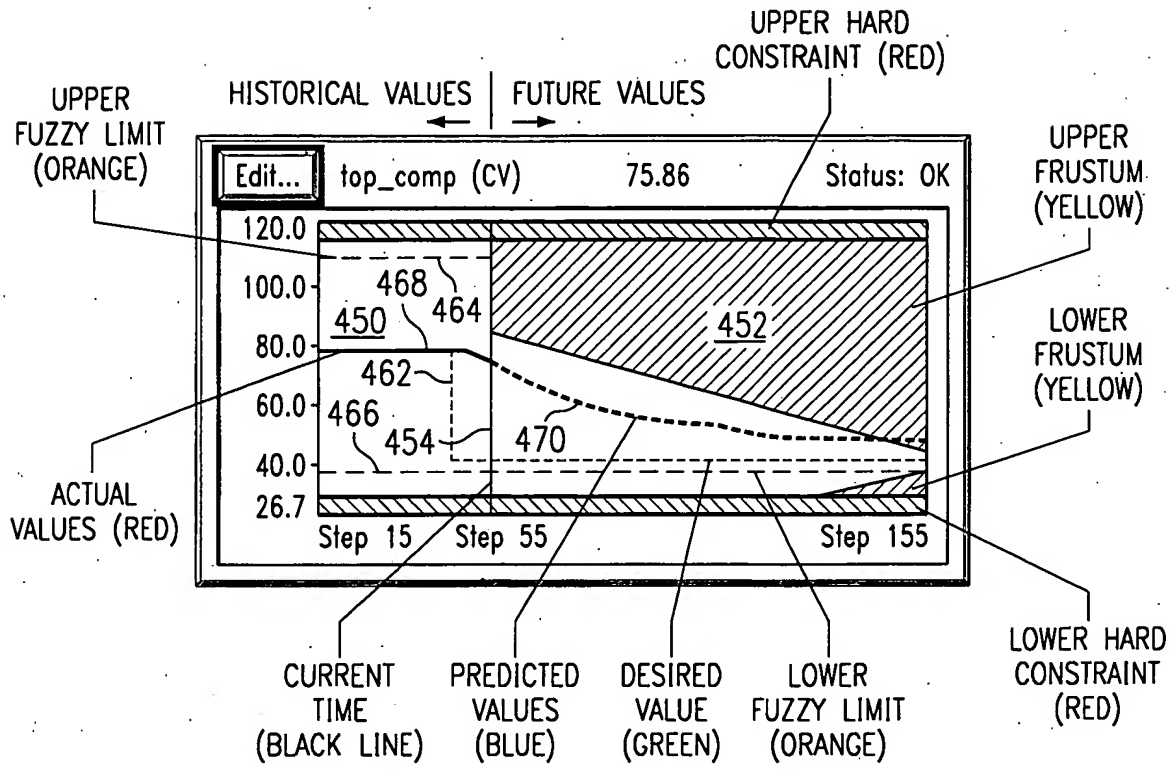

UPPER HARD CONSTRAINT (RED)
UPPER FUZZY LIMIT (ORANGE)
HISTORICAL VALUES
FUTURE VALUES
UPPER FRUSTUM (YELLOW)
Edit...
top_comp (CV)
75.86
Status: OK
120.0
100.0
80.0
60.0
40.0
26.7
468
464
450
452
462
466
454
470
LOWER FRUSTUM (YELLOW)
ACTUAL VALUES (RED)
Step 15
Step 55
Step 155
LOWER HARD CONSTRAINT (RED)
CURRENT TIME (BLACK LINE)
PREDICTED VALUES (BLUE)
DESIRED VALUE (GREEN)
LOWER FUZZY LIMIT (ORANGE)

FIG. 40

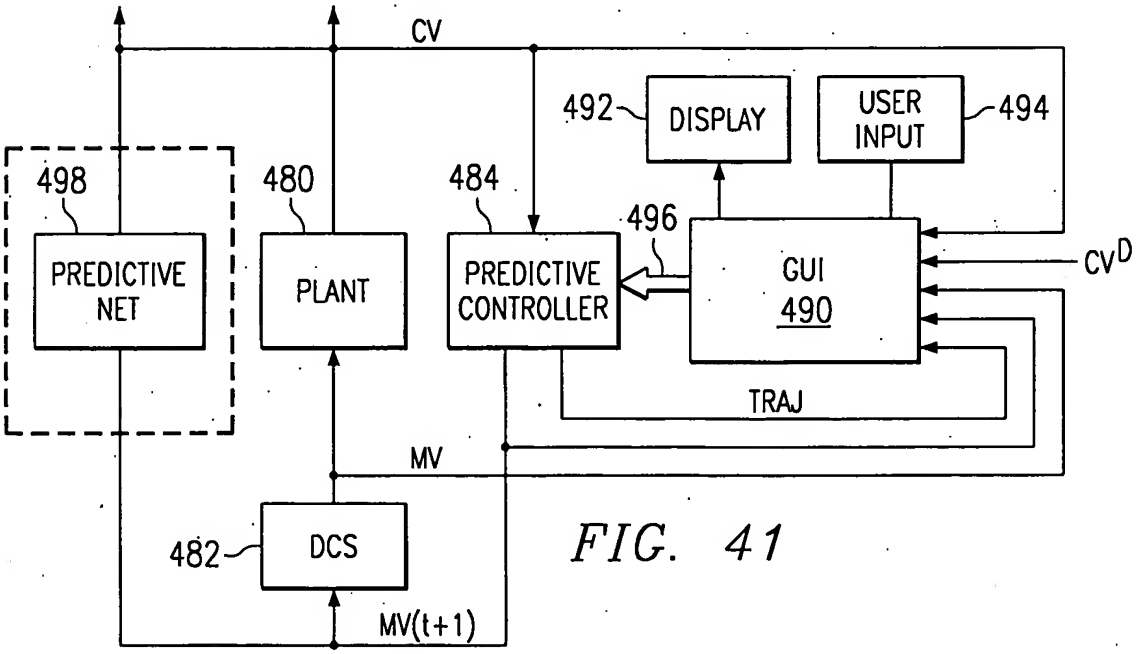

CV
492
DISPLAY
USER INPUT
494
498
480
484
496
PREDICTIVE NET
PLANT
PREDICTIVE CONTROLLER
GUI 490
CV^D
TRAJ
MV
482
DCS
MV(t+1)

FIG. 41

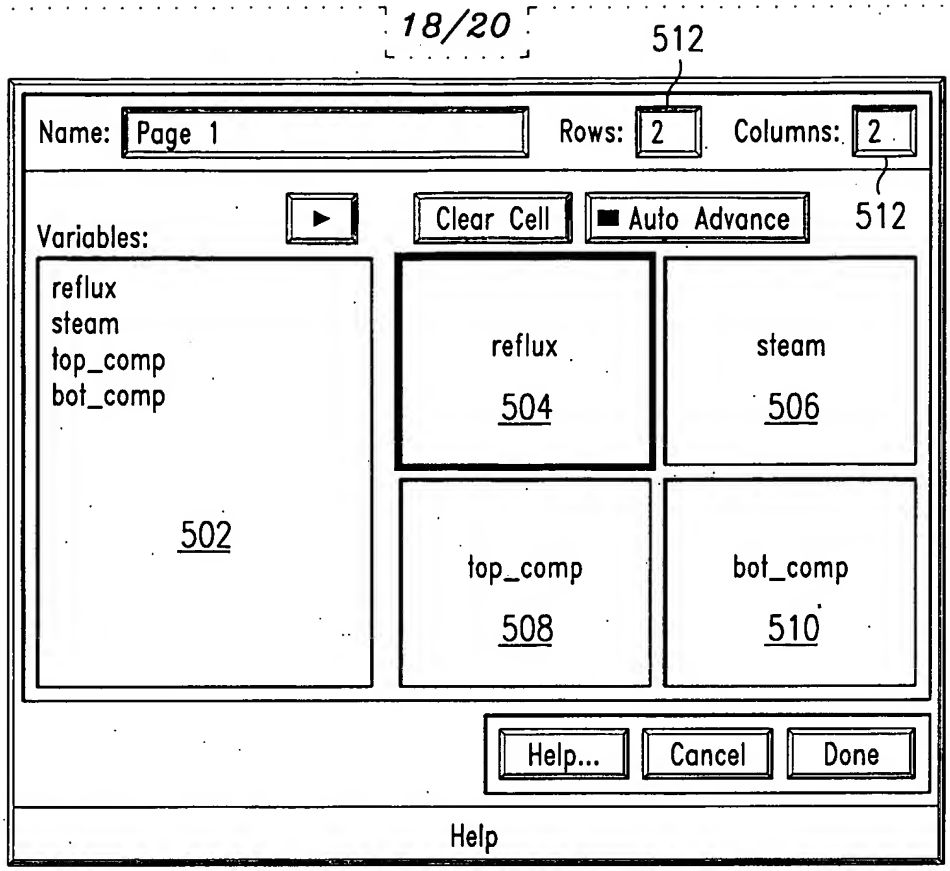

512
Name: Page 1
Rows: 2
Columns: 2
512
Variables:
Clear Cell
Auto Advance
reflux
steam
top_comp
bot_comp
502
reflux
504
steam
506
top_comp
508
bot_comp
510
Help...
Cancel
Done
Help

FIG. 42

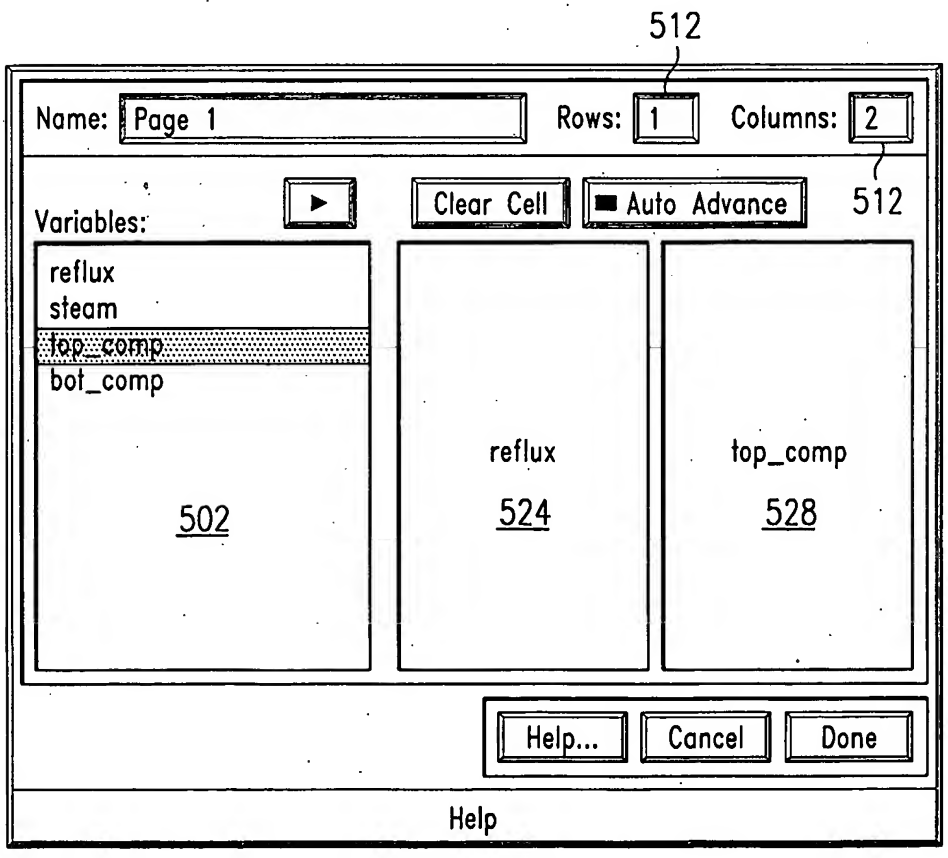

512
Name: Page 1
Rows: 1
Columns: 2
512
Variables:
Clear Cell
Auto Advance
reflux
steam
top_comp
bot_comp
502
reflux
524
top_comp
528
Help...
Cancel
Done
Help

FIG. 44

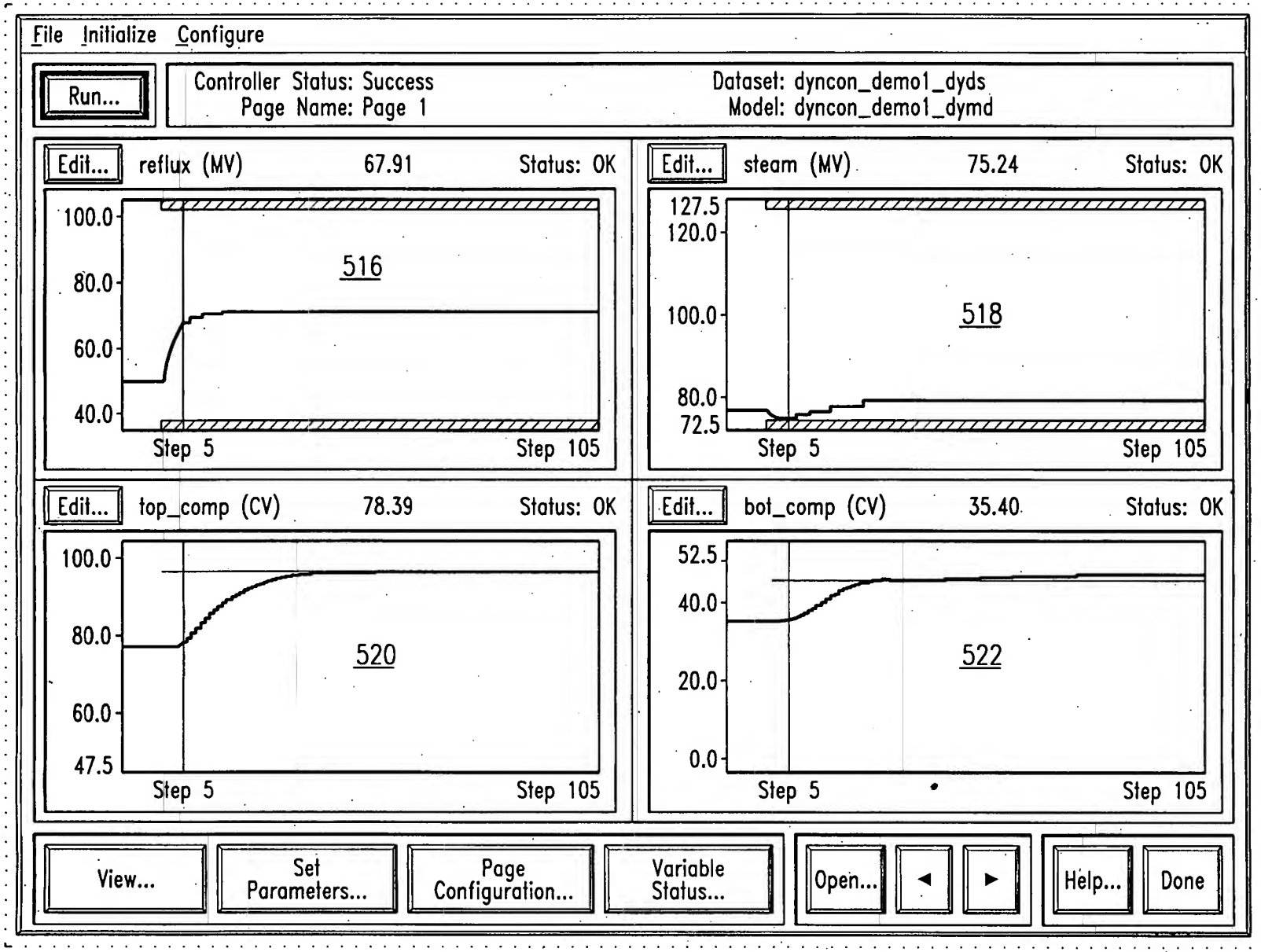

File Initialize Configure
Run...
Controller Status: Success
Page Name: Page 1
Dataset: dyncon_demo1_dyds
Model: dyncon_demo1_dymd
Edit...
reflux (MV)
67.91
Status: OK
100.0
80.0
60.0
40.0
516
Step 5
Step 105
Edit...
steam (MV)
75.24
Status: OK
127.5
120.0
100.0
80.0
72.5
518
Step 5
Step 105
Edit...
top_comp (CV)
78.39
Status: OK
100.0
80.0
60.0
47.5
520
Step 5
Step 105
Edit...
bot_comp (CV)
35.40
Status: OK
52.5
40.0
20.0
0.0
522
Step 5
Step 105
View...
Set Parameters...
Page Configuration...
Variable Status...
Open...
◄
►
Help...
Done

FIG. 43

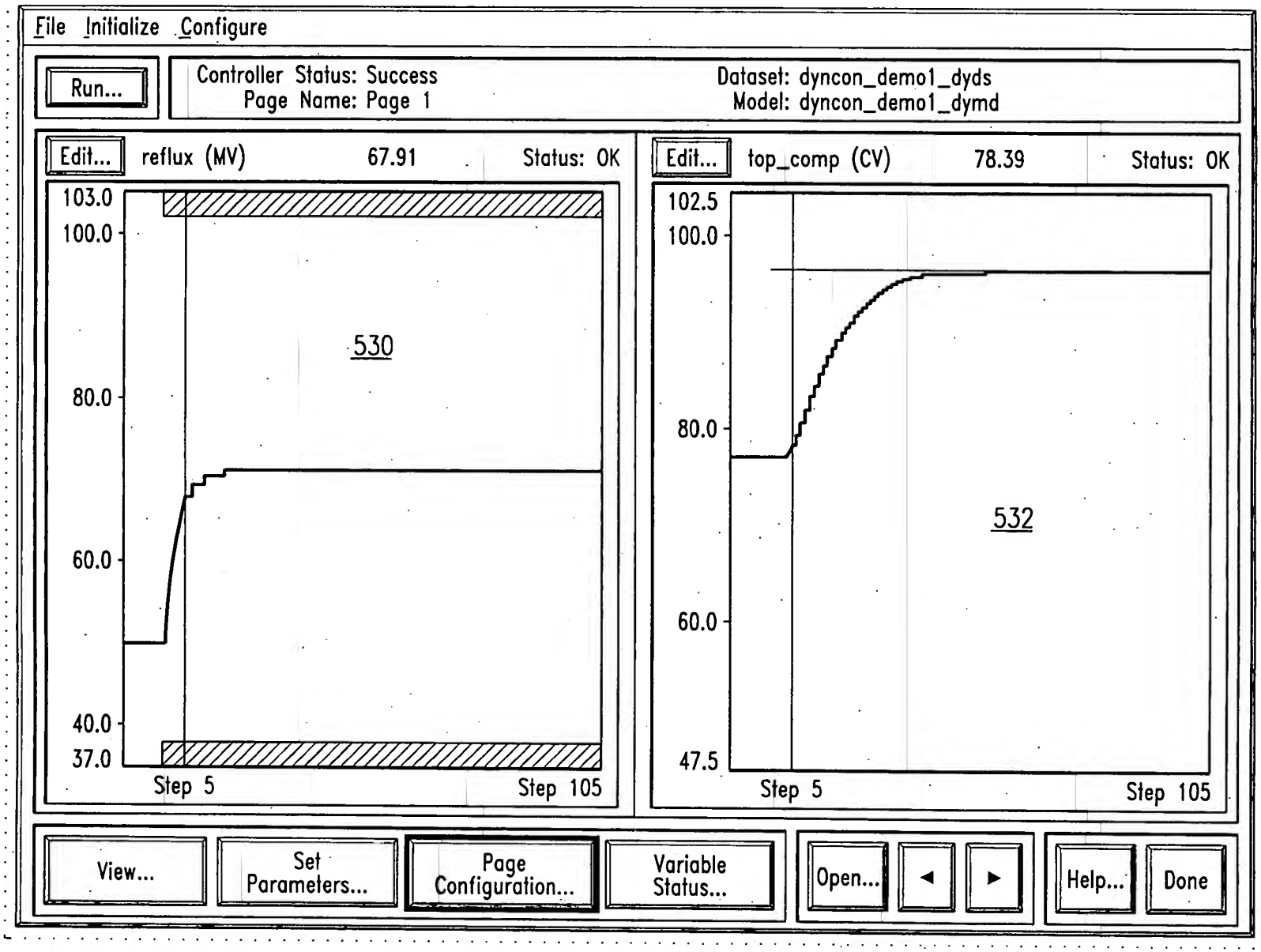

File Initialize Configure
Run...
Controller Status: Success
Page Name: Page 1
Dataset: dyncon_demo1_dyds
Model: dyncon_demo1_dymd
Edit...
reflux (MV)
67.91
Status: OK
103.0
100.0
80.0
60.0
40.0
37.0
530
Step 5
Step 105
Edit...
top_comp (CV)
78.39
Status: OK
102.5
100.0
80.0
60.0
47.5
532
Step 5
Step 105
View...
Set Parameters...
Page Configuration...
Variable Status...
Open...
◄
►
Help...
Done

FIG. 45